UNCLASSIFIED

Information Science and Technology Seminar Speaker Series

Charles A. Bouman
Electrical and Computer Engineering
Purdue University

Model-Based Imaging

Wednesday, March 6, 2013

3:00 - 4:00 PM

TA-3, Bldg. 1690, Room 102 (CNLS Conference Room)

Abstract: Over the last two decades, model-based imaging techniques have emerged as a principled framework for understanding and solving many of the most important problems in imaging research. The approach of model-based imaging is to construct a model of both the image and the imaging system, and then to use this integrated model to either reconstruct an unknown image, or to estimate unknown parameters. So for example, model-based image reconstruction and parameter estimation can be used to robustly form images from sensors with uncertain calibration. But in addition, model-based imaging can serve as a framework for optimizing the static and dynamic design of imaging sensor systems themselves.

In this talk, we review some techniques and recent successes in model-based imaging. Two application domains that we consider are tomographic reconstruction from multislice helical-scan CT and electron microscopy, two very different sensors that share much in common when viewed from the perspective of model-based imaging. For both cases, we discuss a variety of technical innovations, which either improve image quality or reduce the computational burden. We then show results, which demonstrate the value of the methods both quantitatively and qualitatively, on a variety of real and simulated datasets. Finally, we conclude with a philosophical discussion of the future potential of model-based methods, and we present some emerging ideas in prior modeling of images, which have potential to substantially improve upon current results.

Biography: Charles A. Bouman is the Michael J. and Katherine R. Birck Professor of Electrical and Computer Engineering at Purdue University where he also holds an appointment in the School of Biomedical Engineering and serves has a co-director of Purdues Magnetic Resonance Imaging Facility. He received his B.S.E.E. degree from the University of Pennsylvania, M.S. degree from the University of California at Berkeley, and Ph.D. from Princeton University in 1989.

Professor Bouman's research focuses on inverse problems, stochastic modeling, and their application in a wide variety of imaging problems including tomographic reconstruction and image processing and rendering. Prof. Bouman is a Fellow of the IEEE, AIMBE, IS&T, and SPIE. He has served as the Editor-in-Chief of the IEEE Transactions on Image Processing, Distinguished Lecturer for the IEEE Signal Processing Society, a member of the IEEE Signal Processing Societys Board of Governors, and the Vice President of Publications for the IS&T Society. Currently, he is Vice President for Technical Directions of the IEEE Signal Processing Society.

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